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THE ACHIEVEMENTS IN SCIENCE AND TECHNOLOGY

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THE ACHIEVEMENTS IN SCIENCE AND TECHNOLOGY

[Following are the translations of five articles from
Chieh-fang Jih-pao (Liberation Daily), Shanghai, 5 and 19
February 1959, 4 June 1959, 29 September 1959 and 6 October
1959.]

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ELECTRICAL MACHINERY PLANT'S TECHNOLOGICAL REVOLUTION
ROARING AHEAD FULL STEAM IN SHANGHAI

[Following is the translation of an article
appearing in Chieh-fang Jih-pao (Liberation Daily),
Shanghai, 5 February 1959, page 17]

The mass movement and the technological revolution in the Shanghai Electrical Machinery Plant are roaring ahead full steam. The staff and workers have raised more than 6,000 technical revolution ideas and suggestions. They are determined to raise their labor productivity another 33 percent.

In order to realize greater Leap Forward this year, the Party committee has organized the masses since early this year to summarize last year's achievements, to develop advanced experiences and to promote mass movements and the technological revolution. They have raised nearly 6,000 ideas and suggestions about the structure of products, the key production factors, the backwardness of industrial techniques, the manual operation, the quality of products and the conservation of materials. The technological revolution was then extended in all directions.

The cadres, the technical personnel and the workers have joined their efforts to revolutionize the structure and design of

of the products. A 15,000 volt-ampere transformer is being reconstructed into a 30,000 volt-ampere transformer based on the principle of the world's first new type generator manufactured by the plant last year. The work is scheduled to be completed before the spring festival. The electric motor workers who had built a 1,500 kilowatt rotor with casting aluminum, have raised another suggestion that they could use casting aluminum to make all kinds of rotors. According to the opinion/prevail in other countries, rotors made of casting aluminum can be used only for induction motor of 200 kilowatt or less. Therefore this suggestion is quite revolutionary. The materialization of this advanced technique will greatly conserve labor and steel material. The designers and workers responsible for making direct current electric motors have improved the process of production and thus helped the saving of about 500 hours of labor on the electric motors they were making at that time.

While renovations were being made on the design of the products, the backward manual operation was also being attacked by the masses and the workers. Mechanization and automation were their targets. In the past, file was used to smooth the surface by hand labor. Now the workers have suggested to improve the efficiency by employing the feng-tung-sha wind-operated grinding wheel. The pan-tou was formerly done by hand operation but the fang-tung pan-tou is now being suggested for substitution. The workers at the carpenter shop

have also suggested to substitute the axe and the chisel with boring machine. They also suggested to alter the milling machine to do the planing and other carpentry works in order to raise the labor productivity.

Many key production problems had been solved during the new technological revolution movement. For example, the planing machine section had suggested the substitution of 12,000 kilowatt rotor p'ao-ts'ao with shuang-tao ko-ts'ao. At the same time, three knives made of hard alloy were suggested to be used with the shuang-tao in order to reduce the man-hour needed for the rotor to finish the same job. Due to high demand on tools, the comrades in the tools section have been trying to revolutionize every tool to make them more efficient. For instance, comrade Yuan Chin-fu has created many milling tools and improved working efficiency 22 times.

At present, the technological revolution is still roaring full steam in this plant. In the last few days, the cells and committees were discussing more measures and ideas to improve the production. The workers are enthusiastic and they are determined to achieve some results before the spring festival.

THE INSTITUTE OF SHIPBUILDING SCIENCE FULLY
UTILIZES THE CAPACITIES OF ITS OLD-AGE
SCIENTIFIC AND TECHNICAL WORKERS

Following is the translation of an article
appearing in Chieh-fang Jih-pao (Liberation Daily),
Shanghai, 19 February 1959, page 4

Old-age scientific and technical workers of the Institute of Shipbuilding Science have showed their determination to achieve a greater Leap Forward this year and to contribute more for our booming shipbuilding industry. Except three of them are assigned administrative duties, dozens of engineers of the institute are currently undertaking important research assignments on large number of new subjects concerning the shipbuilding industry.

The political thinking of these old-age scientific and technical workers has been lifted to a new level last year with the rectification campaign and the anti-rightist struggle. During the Great Leap Forward, many old-age technical workers, under the guidance of the Party, have changed their attitude and their view toward their job. In the past, their only concern was their personal gains. They were isolated from the masses and were doing works not of practical nature. Now they are consolidated with the masses and they realized that their contributions are for the benefit of the masses. Thus they are

more concerned with their work and what they can do to help the progress of the industry. Last year, the number of research work completed by these old-age technical workers was about one half of the total completed in the institute. They have also helped younger technical workers to complete a large number of research jobs and to improve the technical standards. During last year's Great Leap Forward, quite a few old-age technical workers changed their old tradition of working individually and worked with young members of the institute and the masses. Engineers Lu I-shou, Chang Chu-i, Ching Tse-yung, etc., who were responsible for the research work on the electrical system in the ship, have been giving out numerous research items to younger technical workers and have been holding regular technical meetings to discuss technical problems and to hear opinions of younger members. They have assisted younger technical workers with experienced advices and all kinds of reference materials. Many engineers are teaching younger colleagues both research techniques and theoretical foundations. This year, engineers have been taking technical workers to Chou-shan fishing ground and factories, etc., to learn from the masses and to set up cooperative relations with many related units.

These old-age scientific and technical personnel, under the leadership of the Party, have now realized that only by following the guidance of the Party and by consolidating with the masses, they can better reform themselves and can better utilize their talents. Just

as some of them had said: "In the past we could find very few persons to assign research jobs. But since last year, under the leadership of the Party and by relying on the masses, we had found a correct path to do scientific research work faster and with less cost."

The progress achieved and the positive effectiveness exerted by these old-age scientific and technical workers have received encouragement and attention from the Party and the masses. In the summarization and appraisal of last year's work, engineers Lu I-shou, Chang Chu-i, and Ching Tse-yung were declared as victorious workers.

In early this year, the old-age scientific and technical workers have made a further step to commit themselves to study the decisions of the Sixth Party Congress, which gave them more faith and encouragement. In the middle of last month, they committed themselves in this year's Great Leap Forward. Fang Wen-chun, the assistant director of the institute, has since changed his attitude and thinking. Except taking charge of certain technical control work, he is currently directing research works on the "trial run of river water-wing passenger boat", the "preliminary design of ocean water-wing passenger ship" and the "study and compilation of rules concerning the structure of coastal and Yangtse River vessels". He said: "We should march forward on the foundation of last Year's progress to learn politics from the Party and to further united with the masses in order to achieve more accomplishments." Many engineers have obtained the cooperation from the factories and the user units to make

their research work more applicable to the production. The research work on the mechanization of wooden boats and fishing boats was carrying out by on-the-spot survey and study in Hunan, Kiangsu and Kuangtung provinces with the participation of engineers and technical teams.

At present, the old-age scientific and technical workers, under the guidance of the Party, have already completed ten research subjects. More research subjects will be blossomed next February when the spring comes again.

NUMEROUS ACHIEVEMENTS IN SCIENTIFIC RESEARCH
AT HUA-TUNG NORMAL UNIVERSITY

[Following is the translation of an article
appearing in Chieh-fang Jih-pao (Liberation Daily),
Shanghai, 4 June 1959, page 5.]

The Hua-tung Normal University, under the leadership of the Party and with the consolidation of teachers and students, has realized numerous achievements in the last few years. The quality of their teaching and their technical standards have thus been greatly improved.

The scientific research work in the Hua-tung Normal University was following the educational line of the party that is that science is to serve the production. The content of the research work was quite broad including the theories of education and science, the study of all kinds of teaching and educational problems and the summarization of experiences. Moreover, the compilation of all kinds of textbooks and reference books, the research on the development and establishment of advanced science, the research on people's economic construction problems, the research on Marx-Leninism and theories and problems involved in China's revolution and construction were also done in this university. With the participation of teachers and students, a total of 2,384 subjects were completed last year. This

has quite a meaning on the people's economic construction and the cultural and educational construction.

The teachers and students have fully exerted the Communist pattern of think boldly and act boldly in their scientific research work. For instance, the department of physics has trial manufactured the electronic accelerator, the mass spectrum meter, 1,500 watt supersonic wave generator and complete sets of micro-wave testing equipment of different specifications, etc. The department of mathematics has trial constructed a Mu-ni type electronic computer. The department of chemistry has trial produced high tensile heatproof resins and plastics. The teachers and students did not have too much experiences in the scientific research at first but under the leadership of the Party they made bold experiments and sought advices from specialists, scholars and experienced worker comrades. Under the assistance of these elements they finally succeeded in their work. The teachers and students of the department of geography are currently undertaking two to three months' survey and research assignment at the Yangtze delta to study the possibility of further development of the region. Achievements were made in the field of humanism too. For example, teachers of the department of history and students of the junior class have compiled historical and geographical materials concerning the Yangtze delta and Chien-tang River estuary in more than a half million words after three months of survey at the locations. They have written 55 thesis, 11 survey reports and a volume concerning

the ancient climate of the Yangtze delta and the Hangchow Bay. They have also finished the drafts of the "Survey on the People's Living Conditions in Shanghai in Last Ten Years Since the Liberation" and the "Important Events of Past Ten Years of the People's Republic of China". These scientific research activities not only provide good materials for national construction but also create favorable conditions for the consolidation of education, productive labor and scientific research. The department of education has also done some research work such as the compilation of reference material in the history of education in China and the writing of teaching materials based on the principle of Marxism-Leninism. The teachers and students of the department of political education have compiled a historical work called the "Red Flag of Ssu-ming-shan" during their study trip to the old base of revolution at Ssu-ming-shan in Chekiang province. They have also written a pamphlet called the "Philosophy of the Farmer" for the local consumption. These theoretical but practical scientific research activities have greatly raised the analytical ability and the theoretical standard of the teachers and students.

This year, in order to raise the standard of scientific research and the quality of teaching, more scholastic activities were encouraged by emphasizing the theme of "let a hundred flowers bloom and a hundred schools of thought contend". According to incomplete statistics, 121 meetings or discussions of scientific nature were held from the middle of March to the late May. 153 subjects or

topics were read and discussed and the number of persons participated was as large as 15,249 man/time. These activities have a large effect on the improvement of teaching and scientific research standards.

With the learning of Marxism-Leninism and dozens of years of experience and practice, many old teachers revised their teaching materials from time to time. Since the Great Leap Forward, teachers have been undertaking theoretical research and technical application at the same time. They have written more than 100 teaching materials from their experiences. Thus the scholarstic standard of the students will be raised and these young fellows will be rapidly trained to be good teachers for the people. (Lin Chi-kao)

GREAT LEAP FORWARD IN SCIENCE
AND TECHNOLOGY

[Following is the translation of an article by
Hu Yung-ch'ang, Chief Secretary, Shanghai Branch
of the Academia Sinica, appearing in Chieh-fang
Jih-pao (Liberation Daily), Shanghai,
29 September 1959, p.5]

A decade of national construction was indeed ten heartening and glorious years. Ten years before how many persons in Shanghai could foresee such an astonishing development in science and technology in our city?

Shanghai, before liberation, was comparatively advanced in the development of old Chinese culture, science and industrial technology. But at that time the people of Shanghai were burdened by the imperialism, the feudalism and the bureaucratic capitalism which restrained the surge of industries and thus retarded the further development of science and technology. In the early liberation days, the Military Control Commission took over control of nine Shanghai regional institutes of the national scientific research organizations, the "Academia Sinica" and the "Peiping Institute of Science". The total number of personnel of these nine organizations at that time was only about 200. Among these nine institutes the Peiping Academy

of Science's Institute of Materia Medica (predecessor of the present Institute of Materia Medica of the Academia Sinica) was established in 1932. But there were only four persons working in that institute when it was liberated. How could that be called development?

Shanghai was considered an important industrial center at that time. But there were only two research organizations in the field of engineering and technology, an engineering research institute and the Central Institute of Industrial Experimentation. Shanghai had some foundation in the biological science but there were very few basic research works done in the fields of newly developed sciences like biochemistry and biophysics, etc., not mentioning such advanced science and technology like atomic energy, semiconductors, calculation techniques, etc. However, a decade of national construction has completely changed this situation. Research organizations and the scope of their work have both been enlarged. New organizations have been rapidly added. In the ten years period, about 50 to 60 industrial and technical research and experimentation organizations have been established. Some of them are divisions of central industrial agencies and others are divisions of municipal industrial bureaus and industrial corporations. Some industries have set up central laboratories. The majority of industrial plants in Shanghai have organized technical research teams. Research organizations for atomic energy, semiconductors, electronics and calculation techniques have also been established last year. Moreover, a series of research

units have been established for conducting agriculture and medical research. At present there are more than 80 central and municipal (including various industrial corporations) research and experimental organizations in natural science in Shanghai. Their personnel total more than 1,300 which is several tens of times more than the number of personnel engaged in these kinds of work before liberation. Take the Academia Sinica's Institute of Materia Medica as an example, this institute now has a total of almost 400 men. The increase was nearly 100 times in ten years! The establishment and development of these organizations are important achievements in the construction of science in the last decade. It will show great effect in the progress of industries in Shanghai and will help to promote the material and cultural standards of the populace.

These developments and especially the Great Leap Forward of 1958 have changed greatly the backwardness in the fields of science technology. Industries have progressed from the stage of processing, assemblage and repair to the stage of design and manufacture. And at the same time the development was pointing toward quality and quantity. In many fields our standard has already reached the international level. The average utilization factor of open hearth furnace in Shanghai's steel industry is far ahead among world producers. We can now make all kinds of rare metals. We have designed and manufactured 2,000 horsepower diesel engine, 25,000 kilowatt electricity generating equipment and we are now trying to manufacture

50,000 kilowatt generator. Our shipbuilding industry has also progressed from ship repairing to independent shipbuilding. We have already built 5,000 ton class coastal freighters and have completed the design of 10,000 ton class. We did not have industry making heavy machinery prior to liberation but we have now. Complete sets of blast furnace, smelting furnace and steel rolling equipment can be manufactured. The automation technique has had a great progress. We have also trial produced complete sets of remote control device for steam-powered and hydraulic generating station. Our technique for the manufacturing of instruments and meters has progressed. We have made electronic microscope that magnifies by 100,000 diameters. Mu Ni type electronic computer has been placed into quantity production. Electronic instruments, supersonic-wave devices, micro-wave instruments, radio photo-transmission and television are either in production or have been successfully trial produced. The research and application of semiconductors have had a good start which opened up the application of advanced technology such as isotope and supersonic-wave, etc., in industries. In the textile machinery field, we have designed and manufactured the spinningframe, the comprehensive high output comber and the simplified cotton processing machine, etc. The spinning and weaving techniques have been renovated. Our knowledge and technology in chemical industry have been developed rapidly in the last ten years. The activated

dyestuffs can be manufactured now with the quality of some of them up to the international standards. Our pharmaceutical industry now has the capacity for making any kind of drugs listed in handbooks of medicine in all countries. The research and production of plastics have gained good results. In the field of medicine, the communicable diseases and professional diseases have been put under control. Our technique in the treatment of high degree burn has reached the level of world's advanced countries. The heart surgery and other complex techniques are commonly practiced now. Large scale research is being conducted to attack the medical fortresses of cancer and high blood pressure. The effort has met considerable success up to now. The research in traditional medicine has attained great stride. The research in basic theories in the last ten years has met great progress. In the field of mathematics, beside a considerable accomplishments in integral geometry and the theory of functions, the research work in the differential equations, calculus, kai-lu-lun and yun-ch'ou-hsueh has been established. The research work in solid state physics, physical optics and nuclear physics is also being developed. The research work in antibiotics and high polymer chemistry was established after the liberation. The progress in analytical chemistry was rapid. Furthermore, the research work in protein, nucleic acid, enzyme chemistry, nerve physiology, experimental embryology, plant nutrition, plant photosynthesis and physiology of micro-organism, etc., also had considerable development in the last

ten years.

The Leap Forward in scientific research in the last ten years especially since last year proved that we were on a correct and effective path leading toward greater and faster development of science and technology.

Since the Great Leap Forward of 1958, new faces emerged in the field of science and technology. They were as follows:

(1) The establishment of the correct direction that the development of science is for the purpose of serving the production and the socialist construction. This theme has been gradually strengthened. Prior to the rectification campaign, the consolidation of science and production was not strong and solid. During the Great Leap Forward both the state and the local agencies drew up unified plans for scientific research in accordance with the current and future developments of production and culture construction. Various research agencies determined what direction they should follow to consolidate their work with the production. At the same time, research methods were renovated. For example, since last year our agricultural and biological workers have been actually working in the farm hand in hand with the farmers to gain new experiences and to obtain new academic materials. During their study in the field, they have found a number of subjects that worth further theoretical examination. They have recognized that the "plant physiology is the

foundation of rational agriculture" or rather the "rational agriculture is the foundation of plant physiology". A large number of workers specialized in science and technology, mathematics, physical chemistry and mechanics have also been working in the industrial plants and mines to help with technical problems and to make further scientific studies under the actual conditions. These specialists not only engaged in research and experimental works but also employed their knowledge to help the production. For example, several research units of the state research agencies in Shanghai completed 2,628 research subjects in 1958 among which 1,091 items or 41.5 percent had been applied to the production. The other 817 items were considered to be worthwhile for application in the future and 106 items or 4.0 percent were considered not worth for application. The rest of 614 items were considered to be needing further study. In 1957, they had completed only 211 subjects and among them only 64 items or 30 percent were applied to the production. Therefore, we can see that the rectification campaign and the Great Leap Forward had given a hard push to the consolidation of science and production. Only when science and production are consolidated, science can truly be rooted in our father land.

(2) The organization of Communist cooperation among all units and the establishment of over-all planning were realized. Since last year, state and local units have made considerable stride in unified planning to meet both the demand of key projects of the state and the

demand of local production and culture developments. With the overall planning, many important subjects concerning the production and people's health were brought into attention. The research on newly developed advanced science and technology has added numerous subjects of important theoretical studies. Among more than 50 important, advanced theoretical research subjects listed in the Shanghai scientific development planning the majority of them were comparatively new. These subjects are now being intensively studied and considerable results have already been realized.

The important measure to exert potential strength in developing science and technology rapidly was the organization of strong cooperation and coordination among all related agencies in the municipality. In the past, some scientific problems have not been studied either because the individual units did not possess enough strength or because a lack of coordination between units. The situation changed after the cooperation was achieved. For instance, the research work was originally being conducted in individual units and the progress was slow due to lack of faith on the part of the researchers. Last year after an organized effort was conducted jointly by the Institute of Materia Medica, the Institute of Experimental Biology, the Institute of Biochemistry of the Academia Sinica, the Institute of Pharmaceutical Industry of the Ministry of Chemical Engineering, the First and Second Medical Colleges of Shanghai and with the cooperation of numerous hospitals and doctors in

Shanghai to engage in all phases of research work, considerable progress has been achieved. In the past year, cooperation has been widely expanded. In the municipality 19 specialized groups and 89 specialized teams were organized to exert leadership in the research work. These cooperation activities have spurred the organization of plans and the promotion of Communist ideology. They have also changed the capitalist practices of individualism, mutual-monopolism and the "secret" system.

(3) The establishment and practice of working method based on the line of the masses and the rule of "walking-on-two-legs" were realized. The Great Leap Forward was a series of great mass movements and at the same time it was also the great result of mass movements. Is scientific research an undertaking that shall be done by a few persons behind closed doors? Is scientific research an undertaking that can not be spurred by mass movement? These questions were solved last year during our Great Leap Forward movement. In as much as the scientific research is intended to improve the material and culture benefits of the masses and in as much as the science is the summarization of the creative spirit and the experiences of the masses with the help of many fields of technical and social workers, science itself is the undertaking of the masses. It is completely possible and most necessary to spur mass movements to carrying out scientific research. Since last year, mass movements in science organizations have been going well. The masses were urged to submit

ideas and suggestions on the selection of research subjects and on the determination of lines and methods of study and they responded enthusiastically which helped the establishment of planning on a solid foundation of the masses. Moreover, they have extended their cooperation to the actual science work and have created an experience of solving key technical problems by concentration of strength. This experience has exerted effective influence on the further development of research work.

More important was the solid footing achieved in the consolidation of specialized organizations and the masses. Since last year, mass movements of scientific research and technical innovation have been vigorously promoted in the whole municipality. Technical research teams were organized in the factories. The People's Communes, schools, hospitals, enterprises and government offices have all been engaging in scientific and technological activities. New developments, inventions, rational suggestions, application of new techniques and trial production of new products, etc., have been popping up like stars in the sky. The scientific and technological activities of mass nature not only have helped the solving of production problems but also provided valuable experiences for the scientific research. At present, many agricultural, industrial and health and sanitation subjects are jointly studied by specialists and the masses.

What attitude should be taken to treat mass movements was thus the very test case for distinguishing the bourgeois revolutionist and

the proletarian revolutionist. The bourgeois of rightist thinking had refuted the feasibility of mass movement in science organizations. Of course, scientific research is a highly concentrated brain work which can not be organized by the same methods as used to organize the industrial or agricultural production. However, the discredit of mass movement in science organizations is in itself an error in basic thinking. Men of bourgeois thinking do not believe that the development of science should rely on the masses. They do not realize that many of our scientific research work are inseparable from the summarized and improved experiences of the masses. The development of today's advanced science and theoretical science is also relying on the most ambitious young science workers to take overbeachheads and to provide reinforcements. If specialists are not consolidated with the masses, the development of science will not be able to march forward rapidly.

(4) A pattern of think boldly and act boldly made possible by liberation of thoughts and elimination of superstition has been developed. Scientific research is a creative undertaking. The substitution of old theories with new ones is of revolutionary nature and is not bounded by any traditions or obsolete rules. But in the past there were many science workers who believed in foreign countries, authorities and scientific conclusions which were considered to be truth in a certain historial period. These person were not brave enough to act boldly in scientific research. Last year the Party

Central had called on the people to rid themselves of unworthy beliefs and to liberate their thought so that the Communist pattern of courage in thinking, speaking and working may be developed. This call had received enthusiastic responds from every corner of the country. Thus science and technology have been liberated from the hands of the few and became a subject that the masses dare to tackle with. The bound of obsolete scientific conclusions upheld by bourgeois class (such as the theories that there is no cure for burns that has damaged more than 85 percent of skin area; when leaf area factor of rice field is larger than 4 the yield will decrease; the fish-seed can not be hatched in autumn season; etc.) had been penetrated. New methods and new ideas are now being raised to study important subjects that are still unsolved in international scene. Since last year, every science unit has been following the newest developments of science and technology in the international scene. Some of the industrial agencies had totally renovated the research work on the newest techniques of production.

Facts proved that these developments were beneficial to the future development of science and technology. But there were still some people who said: "your quantity is large but your quality is not high". Quite correct, a part of our task has still not been completed and therefore the quality of some of our work is still not good enough. But was this not a good start? How could all the work be completed in about a year's time? Besides, the number of work we had

renovated in a year has exceeded that of any year in the past. Take the research work on activated carbon as an example, the capitalist countries had many years of background while we started from a small factory in a narrow street, we now are producing 13 kinds of dyestuffs of international standards. Therefore, we can say this, though our research and production of activated carbon have not overtaken those of foreign countries in all aspects, should our accomplishments so far be praised instead of being laugh at? Since this year, various units have put more attentions to the appraisal of scientific results. This gives better assurance to the quality of the research work. Any pretext of so-called "low quality" to discredit the Communist pattern of think boldly and act boldly is a kind of rightist thinking that should be instantly resisted.

To strengthen the cooperation between all branches of science in the research work and to take the line of the mass participation are the roads stipulated and pointed out by the Party in accordance with the spirit of the socialist construction General Line. We shall consistently advance along these roads, under the leadership of the Party, to spur the initiative of the masses and science workers and to sweep away all kinds of rightist or conservative barriers. The scientific research undertaking in Shanghai was largely developed after the liberation. Although we have so far achieved considerable results, our research work can still not satisfy the development of production and is still behind the standard of world's advanced

countries. Therefore, we should give more effort in this field in order to attain the rapid advancement of science and technology. Continued Leap Forward without complacency is the key to our objective.

ELECTRONIC DEVICE FOR MEASURING DISTANCE IN SURVEYING

[Following is the translation of an article
appearing in Chieh-fang Jih-pao (Liberation Daily),
Shanghai, 6 October 1959, page 3.]

The first micro-wave distance measuring device made in our country was born not long ago in Shanghai Electronic Research Institute. This new instrument was successfully trial manufactured under the cooperation of Hua-tung Normal University, Peking Institute of Electronics and other units. It employs the traveling time of the electro-magnetic wave on the surveying line or the phase difference appeared after the traveling of the electro-magnetic wave to compute the distance surveyed.

The effective measuring distance of this device is from 200 meters to 20 kilometers. It is effective when operating in fog or light rain conditions. Its error is less than $5/100,000$. According to the design, 12 readings can be taken from each surveying line. Experienced operators only take about 15 minutes from the recording of readings from the indicator to the calculation of actual distance.

The successful trial manufacture of micro-wave distance measuring device not only improved the accuracy of surveying but also overcame the restriction of natural conditions. It also raises the speed of surveying.